ICSPE-428
The Effects of Concept Mapping on Student Nurses' Learning of Medical-Surgical Nursing

Julia Sze Wing Wong [a], Baaska Anderson [b]
[a] School of Nursing, Tung Wah College, Hong Kong
[b] University of Liverpool, United Kingdom
E-mail: juliawong@twc.edu.hk [a], baaska.anderson@online.liverpool.ac.uk [b]

Abstract

Many student nurses are weak in studying medical-surgical nursing because high-order and critical thinking skills are required to understand and incorporate prior knowledge with new knowledge, and they are expected to formulate a holistic nursing care plan. Concept mapping (CM) was adapted in medical-surgical nursing course in a higher private education institution in Hong Kong to enhance their learning. This study aimed to examine the effect of CM on student nurses' learning experience, specifically the difference in academic performance of students who learned this subject by using CM and those who did not. Difference in academic performance based on five learning styles using Fleming's visual, aural, read/write, kinaesthetic, and multimodal (VARK) model was also explored. Results showed that the passing rate of CM and non-CM groups was 100% and 77.59%, respectively. The difference between the CM group (M=77.90 and SD=8.09) and non-CM group (M=57.56 and SD=10.16) was statistically significant (p<0.000) with a large effect (Cohen's d=2.21). However, no significant difference was observed in students with different learning styles, thereby suggesting that students with different sensory modalities benefit from CM use. In addition, 26 student nurses were interviewed during focus group discussion. Students perceived CM as an effective tool to determine the relationships between nursing problems and nursing interventions in a systematic and well-organized manner via categorization. This form of presentation provides them a clear and overall picture in a short period, thereby enhancing their understanding, memorization, and retention of topic. Overall, using CM improved academic performance, and students gained a good understanding of relationships between concepts in medical-surgical nursing, particularly for students who are new in the subject.

Keywords: concept map, VARK model, medical-surgical nursing, learning style, learning preference

1. Background, Objectives, and Goals

Medical-surgical nursing is a core subject and arranged as a series of four courses over five-year bachelor nursing programme in Hong Kong. However, passing rates are relatively lower compared with other nursing courses. Many student nurses informally reflected difficulty

in comprehending medical-surgical nursing knowledge because high-order and critical thinking skills are required (Kaddpura, Van-Dyke & Yang, 2016). This reason is acceptable because students are first required to understand and incorporate prior knowledge, e.g., anatomy and physiology, with new knowledge. Student nurses should analyse biological, psychological, and sociological influences in patients, and corresponding nursing interventions should be implemented. Furthermore, nursing interventions embody a five-step nursing process, i.e. assessment, diagnosis, outcome/planning, intervention, and evaluation. Consequently, students are expected to formulate a nursing care plan with a holistic approach.

On average, 3-4 organized systems should be taught in each medical-surgical course, and 2-3 diseases should be taught for 2-hour each lecture throughout the 14-week semester. Nurse educators are accustomed in using conventional PowerPoint lectures in classrooms, and scenario-based exercises are given to students to discuss and answer in tutorial sessions. Students are required to self-study using textbook for details. Consistent low passing rate and informal students' feedback illustrated that the current teaching method may not help students to understand the relationship between prior knowledge, i.e., effects of diseases, and new knowledge, i.e., identification of nursing problem and corresponding nursing interventions. Therefore, an effective teaching/learning tool that promotes significant learning, i.e., facilitates the incorporation of new knowledge into prior knowledge, should be determined (Novak, 2010).

Nurse educators use different types of teaching methods, such as group discussion (Platzer, Blake & Ashford, 2000); reflective learning in the USA (Forneris & Peden-McAlpine, 2007); problem-based learning in China (Yuan, Kunaviktikul, Klunklin & Williams, 2008), USA (Jones, 2008), and Hong Kong (Tiwari, Chan, Sullivan, Dixon & Tang, 1999); simulation teaching in Korea (Shin, Ma, Park, Ji & Kim, 2015); and concept mapping (CM) in Taiwan (Lee, Chiang, Liao, Lee, Chen & Liang, 2013; Tseng, Chou, Wang, & Ko, 2011), Canada (Harrison, & Gibbons, 2013), and USA (Hinck, Webb, Sims-Giddens, Helton, Hope, Utley, Savinske, Fahey & Yarbrough, 2006), to promote critical thinking. Among these teaching tools, CM is efficient and considered a valuable teaching method for incorporating prior knowledge with new concepts in nursing and other disciplines (McMillan, 2010; Pottier, Hardouin & Hodges, 2010; Sadler, Stevens, Willingham, 2015).

In nursing education, numerous studies revealed statistically significant improvement in students' problem solving (Tseng, Chou, Wang & Ko, 2011) and critical thinking skills when CMs are used to prepare nursing care plans (Atay & Karabacak, 2012; Lee, Chiang, Liao, Lee, Chen & Liang, 2013; Moattari, Soleimani, Moghaddam & Mehbodi, 2014; Wheeler & Collins, 2003). Specifically, Atay and Karabacak (2012) used the California Critical Thinking Disposition Inventory to measure differences in students' critical thinking ability between

control and experimental groups in Turkey. Results revealed significant differences in the post-tests of these two groups. Moreover, students who learned using CM score significantly higher in critical thinking than those who did not. Lee et al. (2013) used critical thinking scale to measure students' critical thinking at four different time points for both control and experimental groups in Taiwan. Results showed that experimental group exhibits higher critical thinking score than control group across time. Moattari et al. (2014) used 17 dimensions of critical thinking to evaluate differences between control and experimental groups in Iran. The experimental group performs significantly well in five out of seven areas related to cognitive thinking skills and six out of 10 areas related to mind habit. Wheeler and Collins (2003) used the California critical thinking skills test to assess students' critical thinking skills between the control and experimental groups in the United States; their results revealed that critical thinking skills of students in experimental group are significantly improved. In Kaohsiung, Tseng et al. (2011) showed that scores in experimental group are higher than those in control group for critical thinking scale, self-directed learning scale, and students' performance in problem-based learning tutorial session questionnaire. Problem-based learning combined with CM can enhance students' critical thinking skills, personal accountability for self-directed learning, skills for independent study, reasoning, group interaction, and active participation. These studies indicated that students' critical thinking skills in CM group significantly improve compared with non-CM group.

In addition, student nurses also reported a positive learning experience from using CM (Harrison & Gibbons, 2013; Hinck et al., 2006; Kostovick, Poradzisz, Wood & O'Brien, 2007). Hinck et al. (2006) compared the difference in CM of care plans at the start and end of a course by comparing the scores. Student satisfaction and self-assessment of learning questionnaire was also used to collect quantitative and narrative data. Results revealed that scores of the second CM are higher than those of the first. CM is a time-consuming tool, but it is easy and quick to use after frequent practice. Some students also find it beneficial. Nevertheless, some students preferred traditional care plans because they are used to writing things down instead of presenting a diagram. Harrison and Gibbons (2013) conducted 12 individual interviews. They found that students who are considerably motivated and open minded perceive the usefulness of CM, and these students present a positive experience. Workshops with constructive feedbacks are important in helping students master the skills of CM. Furthermore, students find the tool time consuming and frustrating. Their negative feelings lessen with the increase of their skills. Factors contributing to successful CM include its easy and quick usage. These participants perceived themselves as visual learners, and the tool is favourable to them. The present study revealed the relationship between CM and sensory modalities. Kostovick, Poradzisz, Wood, and O'Brien (2007) used mixed research methods to measure differences between CM grades and different Kolb's learning style groups, i.e., abstract conceptualization, concrete experience, reflective observation, and active experimentation, because they wanted to

explore student's learning style as an indicator of aptitude in developing CM. Learning style survey results were compared with the CM grades, and no significant difference was observed between them. Therefore, CM is effective for students who use all kinds of Kolb's learning styles. In addition, Kostovick and her colleagues used an author-developed survey with four open-ended questions to assess a students' experience. Five codes were identified and associated with learning effects, i.e., comprehensive, critical thinking, organization, relevance, and fitness to learning style. Another five codes were associated with the learning process, i.e., drive to research and be creative, and being burdensome, inconsistent, and confusing.

These studies were implemented in teaching medical-surgical nursing where students were asked to use CM to formulate nursing care plans in in-class case study discussions or for actual patients during their clinical practice. However, the present study only focused on in-class scenario-based exercises because the ability of formulating an appropriate care plan is the most significant concern when teaching medical-surgical nursing. Hence, the effect of CM on clinical learning was not measured.

CM was adapted as a teaching and learning method, along with conventional PowerPoint lectures, in medical-surgical nursing course to improve student learning. This study aimed to examine the effects of CM on students' learning experience. The difference in academic performance (passing rate and grade) between students in CM and non-CM groups was compared. Moreover, several focus group discussions were conducted to explore the students' actual experience on using CM.

Furthermore, CM is a powerful metacognition and visual tool to promote considerable learning. Nevertheless, studies on its effects among student nurses with different sensory modalities are scarce. Thus, this study also examined the difference in academic performance in terms of overall grade and actual experience based on five learning styles using Fleming's visual, aural, read/write, kinaesthetic, and multimodal (VARK) model.

2. Methods

A mixed-method approach was used. CM was implemented in a 14-week medical-surgical nursing course in a private higher education institution in Hong Kong. The target population was students pursuing Bachelor of Health Studies in nursing programme and who were enrolled in the same medical-surgical course during spring and summer 2016 semesters. At the beginning of semester, students were asked to fill out the VARK questionnaire. The scores on this questionnaire were used to identify students' dominant sensory modalities. During the semester, course teachers delivered lectures using PowerPoint and CM. In tutorial sessions, students were required to draw a CM based on scenario-based questions with their classmates; these questions were related to the content taught in lectures.

For the quantitative part of this study, after the semester, the academic performance (passing rate and grades) of CM group was compared with that of non-CM group from previous semester. T-tests and ANOVAs were used to explore the differences in academic performance between these two groups. Group differences were also examined among the CM group based on their dominant learning styles. For the qualitative part, several focus group discussions were conducted to explore the student perceptions of CM effects in their learning process. Thematic analysis was used to analyse qualitative data.

3. Results

3.1 Quantitative Results

CM group comprised 199 students (M=55 and F=144), and non-CM group comprised 241 students. Students' overall grade was used for comparison. The passing rate of CM and non-CM groups was 100% and 77.59%, respectively. The mean grade of the CM group was 77.90 (*SD*=8.09), and that of non-CM group was 57.56 (*SD*=10.16). These values were statistically significant ($p<0.000$) with a large effect (Cohen's $d=2.21$). These findings suggested a substantial improvement in student nurses' learning experience.

Among the 199 students who used CM, 46 students were visual learners, 27 were aural learners, 11 were read/write learners, 21 were kinaesthetic learners, and 72 were multimodal learners. Only 22 students did not complete the VARK questionnaires (Table 1). No statistically significant difference was observed in the overall grade between different sensory modality groups based on Fleming's VARK model (Table 2).

Table 1. Frequencies of VARK in Spring and Summer Semesters (N=199)

Group	*n*	%
Visual	46	23.12
Aural	27	13.57
Read/write	11	5.53
Kinaesthetic	21	10.55
Multimodal	72	36.18
Did not complete the VARK questionnaire	22	11.06
Total	199	100

Table 2. Differences in Overall Grade for Sensory Modalities in Combined Spring & Summer Semesters (N=177)

	n	*M (SD)*	[95% CI]	*p*
Visual	46	78.41 (8.30)	[75.94, 80.88]	
Aural				.928
Read/write				.950
Kinaesthetic				1.000
Multimodal				1.000
Aural	27	80.29 (6.97)	[77.54, 83.05]	
Visual				.928
Read/write				.675
Kinaesthetic				.889
Multimodal				.835
Read/write	11	76.03 (5.09)	[72.61, 79.45]	
Visual				.950
Aural				.675
Kinaesthetic				.992
Multimodal				.967
Kinaesthetic	21	77.77 (8.32)	[73.98, 81.56]	
Visual				1.000
Aural				.889
Read/write				.992
Multimodal				1.000
Multimodal	72	78.11 (8.67)	[76.07, 80.15]	
Visual				1.000
Aural				.835
Read/write				.967
Kinaesthetic				1.000

Note. *M* = mean; *SD* = standard deviation; CI = confidence interval.

3.2 Qualitative Results

In the CM group, 26 students (M=5 and F=21) were interviewed. Five were visual learners, four were aural learners, one was read/write learner, three were kinaesthetic learners, and 13 were multimodal learners. Three topics were identified, i.e., advantages of using CM, approach for written examination preparation, and optimal way of using CM.

3.2.1 Advantages of Using CM

Learners agreed that CM can show the relationships between nursing problems and interventions in a comprehensive, systematic, and well-organized manner via categorization. This form of presentation provides them a clear and overall picture in a short period, which further enhances the understanding of topics, facilitates learning, and promotes good memorization. During group discussions, learners learned from their classmates because they would help provide information, despite missing some points while drawing the CM.

3.2.2 Approach for Written Examination Preparation

However, some learners from all five different sensory modalities did not use the tool for revision and preparation for a written examination. Conventional nursing care plan format was preferred, i.e., table and point forms instead of CM, because it is not time consuming. Furthermore, students could easily prioritize nursing interventions from specific to general. Hence, layout was only confined to a standard paper size. By contrast, the CM coverage can be considerably extensive, which easily confused them. The extensive CM can only be read by a tablet or computer, which caused further inconvenience. In addition, only keywords were used in CM, and details cannot be provided. In particular, students were concerned about the rationales behind nursing interventions. Consequently, PowerPoint notes provided by lecturers and textbooks were read by students. Students subsequently wrote them in table form for revision. The effect of using CM and table forms was similar with writing a nursing care plan. Different layouts were also used. Some students used their own structured methods to memorize nursing interventions. Read/write students expressed that numerous lines in CM caused confusion. Some students were retakers, and they underwent the first clinical practicum after their first admission in the course. Therefore, when they retook this course, they found that their clinical experience, instead of CM, helped them in understanding topics. These retakers also expressed that CM is not an important tool.

3.2.3 Effective Way of Using CM

CM tool only provides keywords, and students suggested that lecturer should add short sentences to elaborate the rationales of nursing interventions. CM colours should only be black and white and confined to printable paper size. In addition, students, as learners, showed uncertainty about the accuracy of their work when they were asked to draw a CM in tutorial sessions. Hence, lecturers were suggested to provide an examination on CM again at the end of tutorial sessions. Detailed model answers should also be provided. PowerPoint presentations should be used as primary learning tool by lecturers, and CM should be used as a supplementary teaching tool.

4. Discussion and Conclusion

Quantitative results revealed that the passing rate in CM and non-CM groups showed a statistically significantly difference (p<0.000) with a large effect. However, no statistically significant difference was observed in the overall grade among visual, aural, read/write, kinaesthetic, and multimodal groups. Results from focus group discussions showed that CM links concepts in a systematic and well-organized manner for a short period, which enhances the understanding of relationship between concepts and promotes good memorization. Additionally, a CM is drawn to answer scenario-based questions with groupmates during tutorial sessions, and further enhances and consolidates the understanding of topics.

Nevertheless, few disadvantages were also identified by students; these disadvantages included its extensiveness, time-consuming nature, and lack of detailed information, and being confusing. The narrative results of this study are in accordance with previous literatures (Harrison & Gibbon, 2013; Hinck et al., 2006; Kostovick et al., 2007). Thus the preference of students to use traditional care plans is also found in the findings of Hinck et al. (2006). This phenomenon may be attributed to the presence of a preconceived notion as textbooks and nursing care plans use traditional table formats. Students may use CM when preparing for examinations and choose a strategy that is effective in memorizing contents in such a limited and critical period. It can also be probably explained with Bandura's (1991) social cognitive theory of self-regulation, i.e., students adjusted their own thoughts, behaviours, and feelings to reach the goal and achieve satisfactory grades.

Both quantitative and qualitative results showed that CM presents a significant effect in learning medical-surgical nursing course, particularly when synthesizing their knowledge and student nurses are first-time enrollees in the course. Nonetheless, few limitations also exist in this study. The teaching content of non-CM and CM groups is the same, but teachers are not the same. In addition, numerous extrinsic and intrinsic factors can affect academic performance, e.g., motivation, self-efficacy, stress, study time, and family- and teacher-related factors. (Shawwa, Abulaban, Abulaban, Merdad, Sara Baghlaf, Algethami, Abu-shanab & Balkhoyor, 2015).

All visual, aural, read/write, kinaesthetic, and multimodal students can benefit from using CM. Results showed that CM helped students understand relationship between concepts in medical-surgical nursing and synthesize their learning in a short period. However, the potential of this tool should be explored further with a large amount of samples in other medical-surgical courses.

5. References

Atay, S., & Karabacak, Ü. (2012). Care plans using concept maps and their effects on the critical thinking dispositions of nursing students. *International Journal of Nursing Practice*, *18*, 233-239.

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, *50*, 248-287.

Forneris, S. G., & Peden-McAlpine, C. (2007). Evaluating of a reflective learning intervention to improve critical thinking in novice nurses. *The Journal of Advanced Nursing,* 410-421.

Harrison, S., & Gibbons, C. (2013). Nursing student perceptions of concept maps: From theory to practice. *Nursing Education Perspective, 34*(6), 395-399.

Hinck, S. M., Webb, P., Sims-Giddens, S., Helton, C., Hope, K. L., Utley, R., Savinske, D., Fahey, E. M., & Yarbrough, S. (2006). Student learning with concept mapping of care

plans in community-based education. *Journal of Professional Nursing, 22*(1), 23-29.

Jones, M. (2008). Developing clinically savvy nursing students: An evaluation of problem-based learning in an associate degree program. *Nursing Education Perspectives, 29*(5), 278-283.

Kaddpura, M., Van-Dyke, O., & Yang, Q. (2016). Impact of a concept map teaching approach on nursing students' critical thinking skills. *Nursing and Health Sciences*, *18*, 350-354.

Kostovich, C. T., Poradzisz, M., Wood, K., & O'Brien, K. L. (2004). Learning style preference and student aptitude for concept maps. *Journal of Nursing Education, 46*(5), 225-231.

Lee, W., Chiang, C. H., Liao, I. C., Lee, M. L., Chen, S. L., & Liang, T. (2013). The longitudinal effect of concept map teaching on critical thinking of nursing students. *Nurse Education Today, 33*, 1219-1223.

Moattari, M., Soleimani, S., Moghaddam, N. J., & Mehbodi, F. (2014). Clinical concept mapping: Does it improve discipline-based critical thinking of nursing students? *Iranian Journal of Nursing and Midwifery Research, 19*(1), 70-76.

McMillan, W. J. (2010). Teaching for clinical reasoning – helping students make the conceptual links. *Medical Teacher*, *32*, e436-442.

Novak, J. D. (2010). *Learning, creating and using knowledge: Concept maps as facilitative tools in schools and corporations*. New York, NY: Lawrence Erlbaum Associates, Inc.

Platzer, H., Blake, D., & Ashford, D., (2000). An evaluation of process and outcomes from learning through reflective practice groups on a post-registration nursing course. *Journal of Advanced Nursing*, 31(3), 689-695.

Pottier, P., Hardouin, J., Hodges, B. D., Pistorius, M., Connault,J., Durant, C., Clairand, R., Sebille, V., Barrier, J. & Planchon, B. (2010). Exploring how students think: A new method combining think-aloud and concept mapping protocols. *Medical Education*, 44, 926–935.

Sadler, K., Stevens, S., & Willingham, J. (2015). Collaborative concept maps: A voice for all learners. *Science Scope*, 38(9), 38-44.

Shawwa, L. A., Abulaban A. A., Abulaban A. A., Merdad, A., Baghlaf, S. Algethami, A., Abu-shanab, J. & Balkhoyor, A. (2015). Factors potentially influencing academic performance among medical students. *Journal of Advances in Medical Education and Practice*, 6, 65-75.

Shin, H., Ma, H., Park, J., Ji, E. S., & Kin, D. H. (2015). The effects of simulation courseware on critical thinking in undergraduate nursing students: Multi-site pre-post study. *Nurse Education Today*, *35*, 537-542.

Tiwari, A., Chan, S., Sullivan, P. L., Dixon, A. S., & Tang, C. (1999). Enhancing students' critical thinking through problem-based learning. In J. Marsh (Ed.), Implementing problem based learning: Proceedings of the First Asia Pacific Conference on Problem Based Learning (pp. 75-85). Hong Kong: The Management Committee of Hong Kong University Grants Committee.

Tseng, H. C., Chou, F. H., Wang, H. H., Ko, H. K., Jian, S. Y., & Weng, W. C. (2011). The effectiveness of problem-based learning and concept mapping among Taiwanese registered nursing students. *Nurse Education Today*, 31(8), 41-46.

Wheeler, L. A., & Collins, S. K. R. (2003). The influence of concept mapping on critical thinking in baccalaureate nursing students. *Journal of Professional Nursing, 19*(6), 339-346.

Yuan, H., Kunaviktikul, W., Klunklin, A., & Williams, B. A. (2008). Promoting critical thinking skills through problem-based learning. *Journal of Social Science and Human, 2*(2), 85-100.